

Abstract Submitted
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The Role of CFD in Undergraduate Fluid Mechanics Education

JOHN CIMBALA, Penn State University — Instruction of undergraduate fluid mechanics is greatly enhanced through integration of computational fluid dynamics (CFD) into fluid mechanics courses and labs. Specifically, students are able to visualize fluid flows with CFD and are better able to understand those flows by performing parametric studies. At Penn State, CFD has been carefully integrated into our introductory junior-level fluid mechanics course, yet displaces only about one class period. The key is to show demonstrations and assign homework that use CFD as a tool that helps students learn the basic concepts of fluid mechanics. The *application* of CFD (grid generation, boundary conditions, etc.), rather than numerical algorithms, is stressed. This is done through use of short, pre-defined templates for FlowLab, a student-friendly analysis and visualization package created by Fluent, Inc. The textbook by Çengel and Cimbala (McGraw-Hill 2006) contains 46 end-of-chapter homework problems that are used in conjunction with 42 FlowLab templates. Each exercise has been designed with two major learning objectives in mind: (1) enhance student understanding of a specific fluid mechanics concept, and (2) introduce the student to a specific capability and/or limitation of CFD through hands-on practice. More templates are being developed that emphasize the first objective. The flow of fluid between two concentric rotating cylinders is a good example of a problem that is solved approximately, analytically, and with CFD, and the results are compared to enhance learning.

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